FLORIDA POLYTECHNIC UNIVERSITY

Capstone Design

Testing & Validation

Alexander R. Murphy, Fall 2024

Learning Objectives

For Today

- Understand the purpose & importance of testing & validation.
- Learn different testing techniques (Usability Testing, Focus Groups, A/B Testing).
- Explore Design of Experiments (DOE) principles.
- Review case studies where testing indicated a need to stop or change direction.

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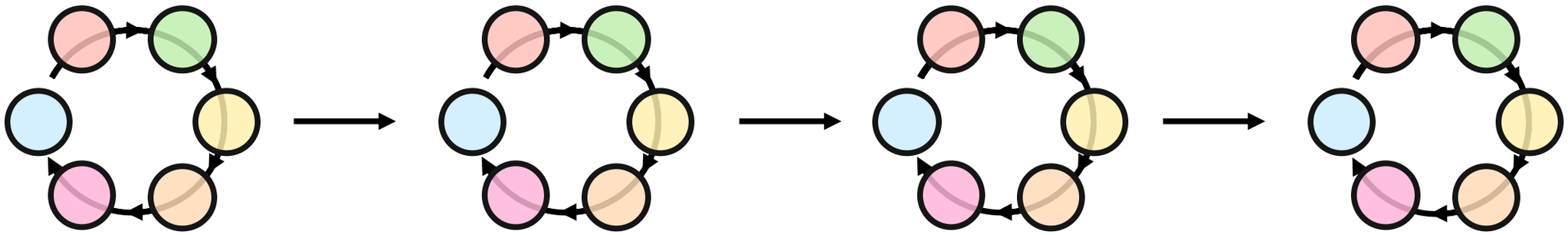
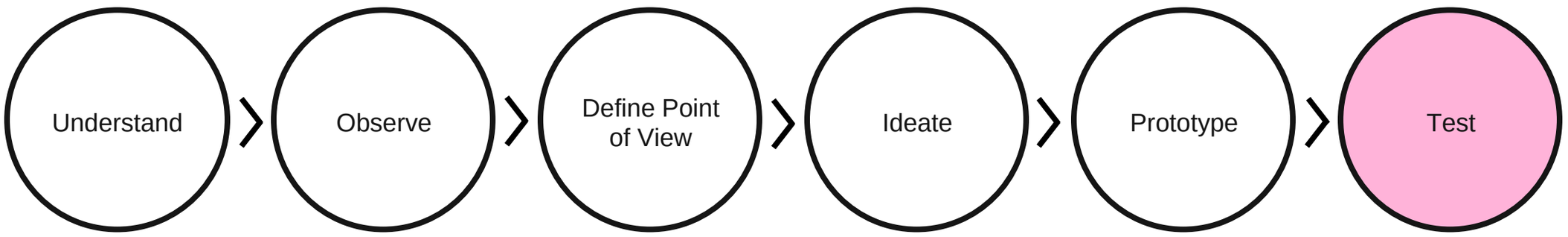
Recall Stage 6: Test

Validation, Verification, Assessment

- Testing should occur for each prototype that is created (physical or virtual). It is important establish a testing plan with measurable metrics to inform the design process.
  - **Appropriate Testing:** A test should fit the context, fidelity, and functionality of a given prototype.





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Testing & Validation

Why is it Important?

- **Uncover Hidden Insights:** Testing helps reveal insights that were not initially considered during the design and prototyping stages, such as unexpected user behaviors or environmental constraints.
- **Validate Assumptions:** Testing allows designers to verify or refute assumptions made during earlier stages, ensuring that the solution is truly addressing the user's needs.
- **Identify Design Flaws:** Early testing can expose issues or flaws in the prototype, allowing for improvements before investing further resources into production.
- **Risk Mitigation:** By identifying issues early, testing reduces the risk of costly failures in later stages of product development.
- **Empathy Building:** Engaging with real users during tests helps build empathy, deepening understanding of their needs and challenges.

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1. Test Preparation

Where? How? What? Who?

- Define clear learning goals and establish hypotheses.
  - What do we want to learn?
  - What to we want to test?
  - With whom are we conducting the test and where?
- What are Good Hypotheses:
  1. Build from Existing Knowledge
  2. Predict a Result
  3. Are Testable!
- **Question Maps:** Ask clear, open-ended questions focused on core insights, encouraging users to share their real experiences.
- **Test Scenario:** Define the test sequence and user situation, providing necessary context, while letting the user experience the prototype without explanation to see if it fits their life/conext.

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2. Conducting the Test

With Users in Context

- Test multiple variants to get differentiated and precise feedback by allowing users to compare prototypes.
- Set the test in the prototype's natural environment or context for more realistic insights.
- Use a team approach for observation and documentation. One person can't do everything!
- **The Moderator:** Guides the user into the test scenario, explains the context, and asks key questions.
- **The Actor:** Plays roles within the test scenario to create an authentic prototype experience, typically for service-based prototypes.
- **The Observer:** Focuses on user behavior and actions, possibly filming for later detailed review

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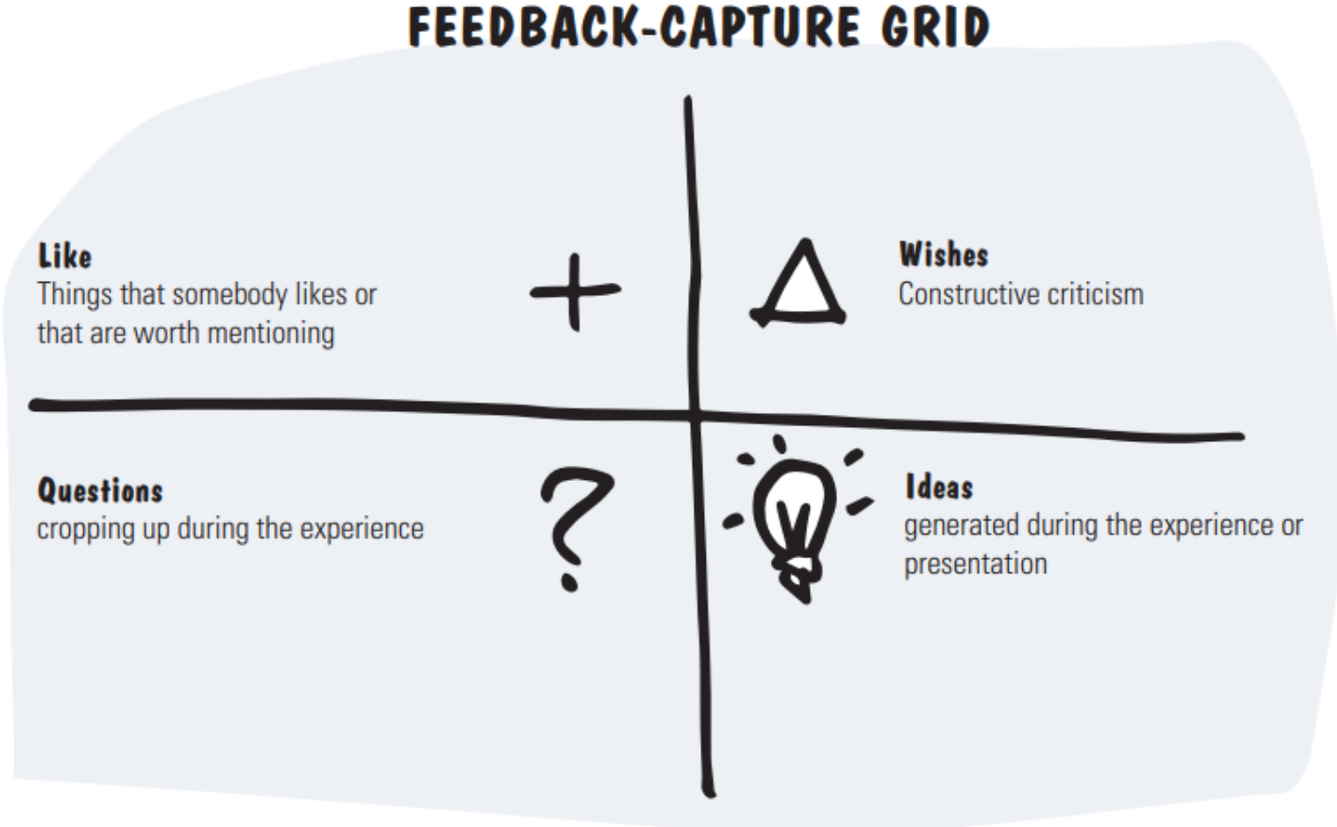
3. Documentation of Results

Archive the Information

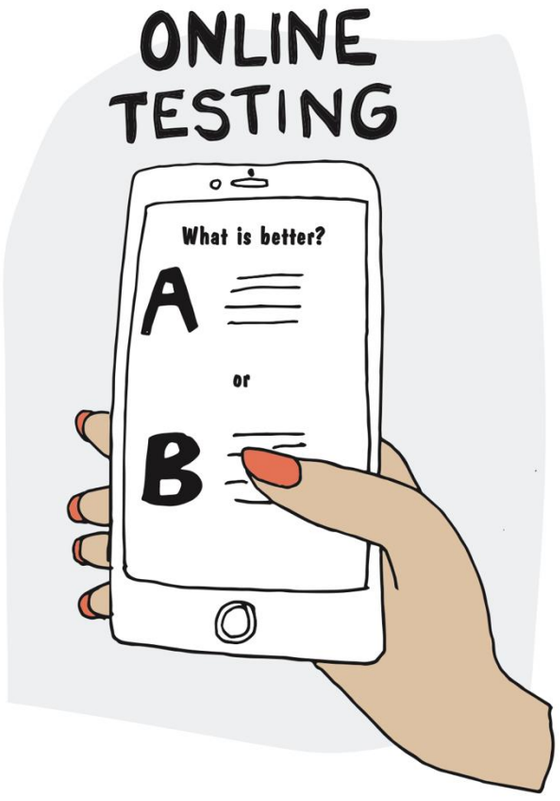
- “I like…,” “I wish…,” “What if…”, and “I learned…”.
- Observe how users interact with the prototype, noting both intended use and misuse without intervening.

- Best Practices:
  - Probe for Richer Feedback
  - Take Photos or Videos
  - Structure Feedback
  - Treat Feedback as a Gift
  - Don’t Justify/Defend
  - Listen Carefully
  - Show Gratitude



Lewrick, Michael, Patrick Link, and Larry Leifer. *The design thinking playbook: Mindful digital transformation of teams, products, services, businesses and ecosystems*. John Wiley & Sons, 2018.

4. Analysis of Outcomes



What Can We Learn?

- **Learning Through Failure:**
  - "Fail fast, fail often" uncover insights.
- **Embracing Mistakes:**
  - Mistakes are valuable in identifying areas for growth and innovation.
- **Documentation of Insights:**
  - Recording and sharing findings ensures that the entire team benefits from the learning process.
- **Analysis Methods:**
  - Statistical analysis, qualitative feedback synthesis, thematic analysis, pattern recognition, short reports, figures vs. graphs.

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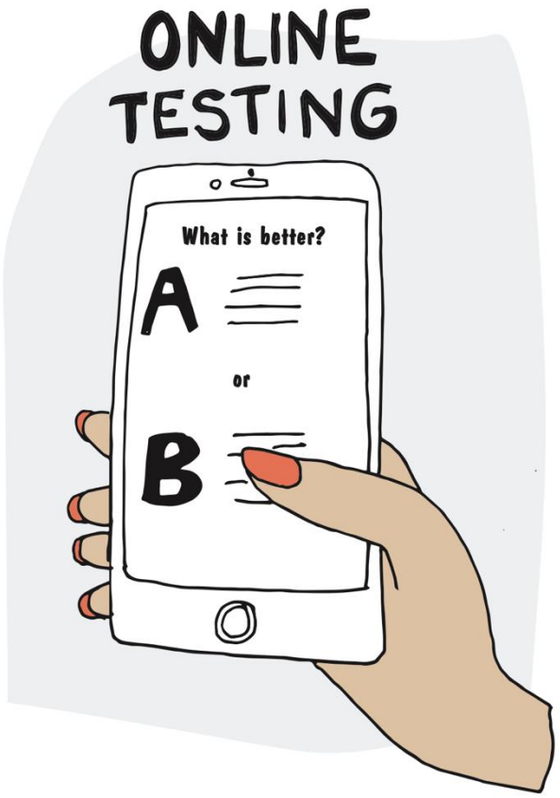
A/B Testing

Experiments With Fancy Name



- Early uses in medicine and marketing
  - Testing effectiveness of drugs
  - Effectiveness of ad campaigns
- Popular with software/web developers more recently
  - Google with search engines in early 2000s
  - Companies are using designed experiments to support decision making
- Useful when comparing two distinct items
  - Concept variants (e.g. text input vs voice input)
  - Levels of something (e.g. high sodium vs low sodium)

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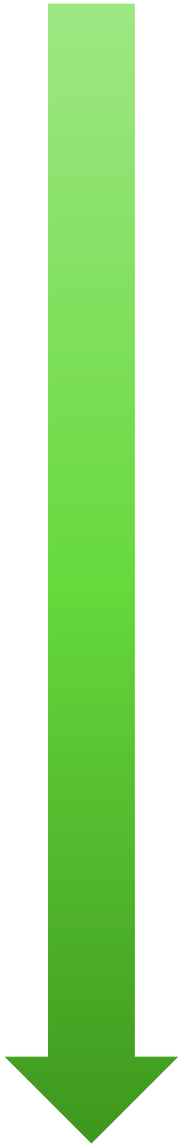
A/B Testing

General Approach

Variables	• Determine test variables and outcome metrics
Participants	• Identify the population of interest
Hypothesis	• State a hypothesis about the treatment/comparison
Execution	• Randomly assign participants to test groups (A or B)
Interpretation	• Compare outcome metrics using statistical tests of significance



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Recall: Interviews 1

The Most Common Types

- **Structured Interviews:**
  - Follow a predefined set of questions.
  - Ensures consistency across multiple interviews.
  - Useful for gathering quantifiable data.
- **Semi-Structured Interviews:**
  - Combines a set of predefined questions with the flexibility to explore new topics that arise during the conversation.
  - Allows for a deeper exploration of customer needs.
- **Unstructured Interviews:**
  - No predefined questions; the conversation flows naturally based on the interviewee’s responses.
  - Ideal for discovering unexpected insights and exploring complex topics.

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Recall: Interviews 2

The Less Common Types

- **Contextual Interviews:**
  - Conducted in environment where the product or service is used.
  - Provides insights into real-world usage and environmental factors affecting the customer experience.
- **Ethnographic Interviews:**
  - Interviews with observation of customers in their environment.
  - For understanding customer behaviors, culture, and context.
- **Phenomenologically-Based Interviews:**
  - Focuses on understanding the essence of users' lived experiences and how they perceive specific phenomena.
  - Encourages participants to describe their experiences in detail, capturing the nuances of their thoughts, feelings, and emotions.

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Focus Groups

For More than Politics Reporters

- A group interview with 6-12 participants of select demographics or population
- Commonly used in market research, political science, usability research, and public health.
- Useful for collecting perceptions and opinions about specific issues
- Unlike an interview, focus group participants are encouraged to build on each other’s responses

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Focus Groups

General guidelines

- Participant group should be homogeneous enough to encourage discussion without conflict/confrontation
- Avoid putting participants who know each other in the same focus group session.
- Informed consent must be obtained from participants BEFORE the focus group session
- Research team should include a moderator and a note taker
- Sessions should be recorded, transcribed, and shared with participants
- Sessions should be scheduled for 30-60 minutes, with time allowed for introductions
- The moderator's role is to stimulate discussion on the topics of interest, not to interview each participant

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Moderated vs. Unmoderated

Different approaches to Feedback Solication

- **Definition:** Facilitator time interaction with participants
- **Immediate Feedback:** Allows for real-time clarification and deeper insights.
- **Guided Experience:** Facilitator ensures specific scenarios are tested.
- **Resource Intensive:** Requires more planning and scheduling.

- **Definition:** Participants complete tasks independently, often using digital tools.
- **Scalability:** Reaches more participants quickly and cost-effectively.
- **Natural Behavior:** Feedback from participants in their own environment.
- **Limited Immediate Insight:** Less opportunity for real-time probing and clarification.

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Design of Experiments

or DOE

- Systematic approach to testing the effects of multiple variables at multiple levels on system performance
- Early application in 1920s by Fisher for agricultural testing
- Aims to reduce the number of tests needed to learn the variability in system performance / outcomes by selecting optimal combinations of input factors
- When should you use DOE?
  - When you have at least two variables influencing the outcome, with at least two level to each variables
  - When you cannot afford (time, money, resources) to test all combinations of input factors

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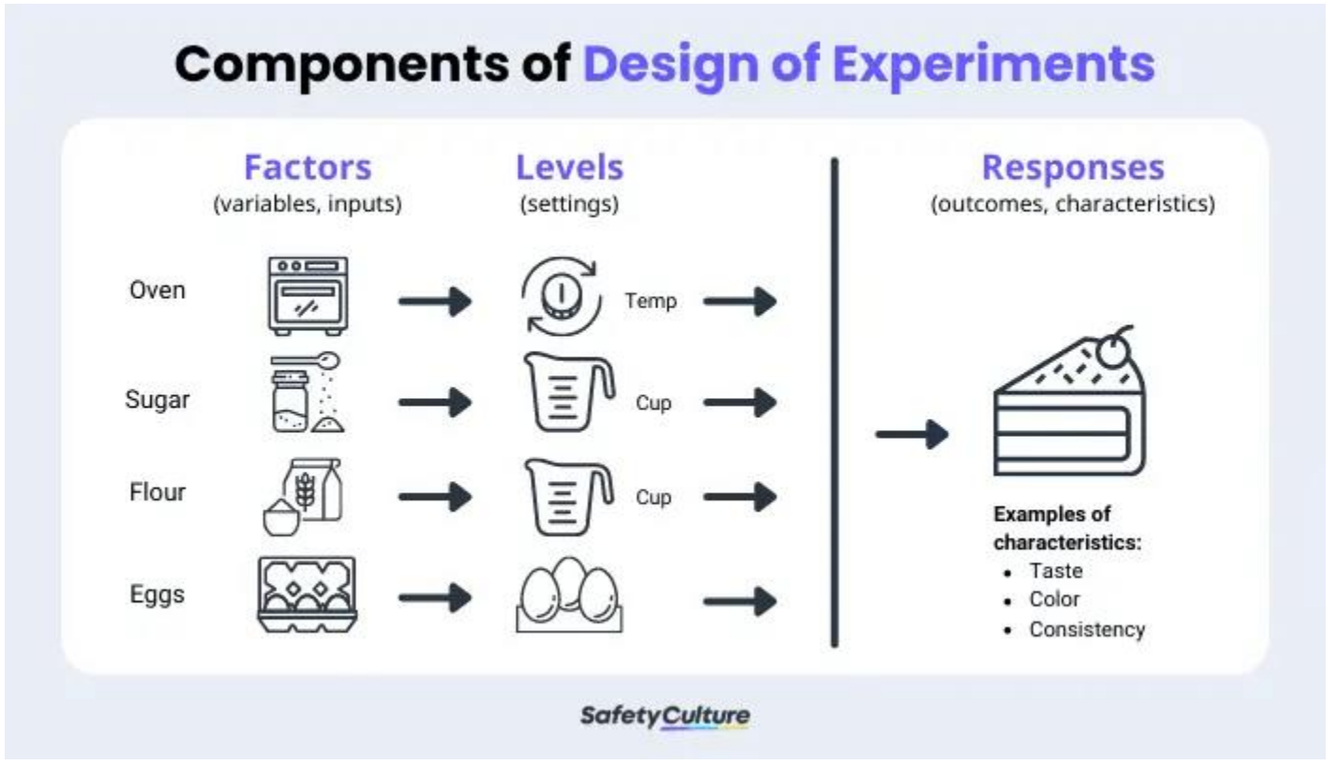
Design of Experiments

The Cake is a Lie!



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Coke-a-Cola Case Study

Testing and Interpretation

- Context
  - “New Coke” is introduced in April 1985
  - Coke has been losing market share for 20 years
    - Partially due to Pepsi’s “taste test” marketing
    - Coke recently got a new CEO who was prepared to take any measures necessary
- Testing
  - Taste tests with small amounts of drink (a few sips)
  - Small focus group in northern USA
  - Comparing taste with competing products
  - Little to no consideration of other factors in product adoption

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Coke-a-Cola Case Study

Testing and Interpretation

- Outcomes
  - Flavor changed to be sweeter
  - Can artwork gets updated simultaneously
  - Outrage from coke drinkers, especially from the south
- What can we learn from this?
  - Participant sampling: make sure to cover as much of your consumer base as you can.
  - Understanding customer needs: was the taste of coke really the problem?
  - Sensation transference: perception of taste/flavor may be influenced other factors unrelated to the recipe (visuals, nostalgia, emotional connection, etc.)

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Systems Approach

Verification, Validation & Testing